MEMORANDUM TO: File

FROM: Al Kopf, Planning Department

SUBJECT: Notes Regarding Environmental Factors and Hillside Development

DATE: June 30, 1986

NOTES REGARDING ENVIRONMENTAL FACTORS AND HILLSIDE DEVELOPMENT
(Main Source: "Performance Controls for Sensitive Lands")

Introduction

Willingness to develop land use regulations for sensitive areas is apparently related to the frequency or magnitude of "natural" disasters and/or eminent development pressures. In Los Angeles, during the 1950's, the hillsides were simply flattened by cut and fill construction. Underlying geology, drainage patterns, and soil conditions were ignored. As a result, there were problems with erosion, land subsidence and settlement, and landslides. By 1963, regulations addressed grading regulations, density restrictions and a new role for the geologist.

Poorly regulated hillside development results in more costs to the public via repairs or protective measures to prevent further damage. Increased stormwater runoff and sedimentation from denuded hillsides can increase public expenditures for flood control and stormwater management. It can be more expensive for public utilities to be constructed on hillsides rather than flatter terrain because special engineering is often required.

Stability of each hillside depends on its unique combination of vegetation, climate, soil, and underlying geology. Therefore, regulations must be tailored to local concerns, development and environment.

Environmental Factors Which Lead to Various Regulations

Unlike water, hillsides are not a renewable resource nor do they have clearly defined benefits. But maintaining the equilibrium of a hillside's environment can reduce the threat to public safety and health. This equilibrium can be disturbed by the following factors:

- Loss of slope and soil stability and increase erosion by the removal of vegetation. Plant roots help stabilize the soil. Leaves and branches reduce the impact of wind and rain on topsoil.

- Loss of soil stability increases erosion and affects downstream water quality via siltation.

- Spring thaws or heavy rains can result in mass movements such as landslides and slumps, and flows on unstable slopes.

- Rocks and soils are held in place via friction. An incease in load, earthquakes and spring thaw or heavy rains (saturation) can overcome this friction. The removal of accummulated debris or other formations at the bottom of the hill can also cause a slide. Areas which are particularly vulnerable to disturbance are subject to periodic heavy rains or melting with little soil cover, frequent seismic activity, or very steep slopes.

Slumps/Mudflows - These are caused by oversaturated soil which reduces the friction between particles. Slumps occur in homogeneous (similar) materials such as clay soils; whereas mudflows occur in heterogeneous (dissimilar) materials such as gravels and silt.

Hillsides which are susceptible to landslides, slumps, and mudflows are usually disturbed via decreasing stability of slope and increasing groundwater load. This is often the result of:

- The removal of vegetation which consumes large quantities of water. Elimination of grass, trees and shrubs can increase soil saturation since more water has to be absorbed by the soil.

- The replacement of natural vegetation with new plants which require large quantities of water. As a result, excess water reaches the subsurface geology which reduces the friction between clay and bedrock. This can result in slope failure.

- Development where the water table is normally near the surface. These areas can be susceptible to mass movement (and groundwater pollution).

- Grading (mechanical alteration of the arrangement of rocks, soils, and particles) of the slope. This can increase the possibility of mass movements. The most extreme example is to level a hilltop which can increase erosion, disturb groundwater hydrology, and alter streamflow and drainage patterns.

- Impervious surfaces such as paved parking lots and sidewalks. These can alter existing groundwater hydrology and affect the soil which absorbs virtually no surface water.

Although erosion can be less dramatic than mass movements, it greatly affects the stability of a slope. It is a function of:

SLOPE - The degree and length of slope can affect the amount of erosion.

SOIL - Less permeable (capable of absorbing and retaining water) soils such as clays are more likely to erode than sands and gravels which absorb water more readily.

VEGETATION - Leaves and organic litter reduce the impact of precipitation and increases the soil's permeability.

Disturbance of Hillsides Can Increase Runoff

A stable drainage system is crucial to a stable hillside which is composed of the degree of slope, soil type, vegetative cover, underlying geology, and precipitation pattern.

Streams and tributary water courses carry 35-40 percent of the precipitation that is not retained by the soil or used by plants.

Development of new water courses and drainage systems can increase erosion and the rate of runoff. This can result in downstream damage from siltation and flooding.

Vegetation moderates runoff in a variety of ways. Plants not only stabilize soils and moderate erosion but also absorb large quantities of precipitation. In cold areas, trees can shade accumulated snowfall allowing it to melt gradually. Vegetative litter and roots retain and slow the flow of runoff and help in the percolation of precipitation into groundwater reserves.

Impervious surfaces not only increase runoff (along with siltation and flooding), but less precipitation can enter the groundwater reserves.

Disturbance of Hillsides Can Destroy a Community's Aesthetic Resources

Although it is hard to quantify, degradated hillsides (i.e., erosion, mass movements, loss of vegetation, downstream damage) can deprive a community of its attractive and distinctive setting and decrease real estate values (sites with a "view").

Scattered projects which retain most of the vegetation and distinctive features and follow the natural terrain are not only attractive but safer and ecologically sound.